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ABSTRACT

The purpose of this study was to compare the coronary heart disease (CHD) probability estimates of a group of sedentary males involved in an exercise stress test program from 1968 through 1974 with those of a comparison group of sedentary males not involved in the program. The program was designed to evaluate cardiopulmonary function and improve cardiopulmonary efficiency through exercise programs on the basis of performance feedback from periodic exercise stress test evaluation. Data were collected annually, and CHD risk scores were developed using the following variables: age, serum cholesterol, systolic blood pressure, hemoglobin, relative body weight, cigarette smoking, and ECG patterns. Risk scores for the two groups as a whole did not differ significantly upon entry into the program, but for each year of participation in the exercise stress test program, scores for the comparison group were significantly greater than those in the test group. Conclusions drawn from the study are (1) probability estimates for quantifying the likelihood of CHD development are beneficial in identifying individuals for examination or treatment and for observing difference in risk among groups of people; and (2) sedentary individuals who participate on a regular basis in an exercise program have a significantly lower probability of developing CHD than individuals who do not participate in such a program. (MB)

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THE EFFECT OF A PHYSIOLOGICAL EVALUATION PROGRAM ON CORONARY HEART DISEASE RISK SCORES FOR SEDENTARY INDIVIDUALS

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THE EFFECT OF A PHYSIOLOGICAL EVALUATION PROGRAM ON CORONARY HEART DISEASE RISK SCORES FOR SEDENTARY INDIVIDUALS

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INTRODUCTION

Coronary Heart Disease (CHD) is a disease with changing manifestations, some of which have been clearly defined only in recent times. Factors related to CHD have been evaluated in several countries to explain observed differences in the frequency of CHD in populations and the factors which account for these variations. Generally consistent findings of the major risk factors have been reported in numerous investigations (1,3,5,6,8) indicating multi-factorial interaction in CHD development. Risk factors have been identified and weighted according to their relative contribution to the explanation of the disease variance, and as a result, analytical models useful for translating probability estimates of the development of CHD have been developed. (4)

PURPOSE OF THE STUDY

The purpose of this study was to compare the CHD probability estimates of a group of sedentary males involved in an exercise stress test program from 1968 through 1974 with those of a comparison group of sedentary males not involved in the program.

PROCEDURE

A group of 196 sedentary males of the National Aeronautics and Space Administration (NASA) / Johnson Space Center (JSC) were followed for eight years in a program designed to evaluate cardiopulmonary function and encouraged to improve

their cardiopulmonary efficiency through exercise programs on the basis of performance feedback from periodic exercise stress test evaluation (7). Participants in the test group were made up of a sample of individuals who met a criterion of freedom from recognizable disease that could interfere with a physical conditioning program. Other criteria included the necessity for employment in what was deemed a relatively sedentary position at J.S.C.. The comparison group consisted of 188 individuals who met the identical criteria of the test group but who elected not to participate in the exercise stress test program, or those who did not respond to an invitation for participation in the program prior to the attainment of a pre-determined ceiling on the number of candidates selected for inclusion in the program.

Clinical data were collected from annual physical examinations of the test subjects as well as for the comparison group. By means of the equation developed by Truett, et. al., (9), CHD risk scores were computed and analyses were performed to determine if differences existed between the computed CHD scores of the test group and the comparison group. Variables used for predicting probability of CHD development were:

1. Age;
2. Serum Cholesterol;
3. Systolic blood pressure;
4. Hemoglobin;
5. Relative body weight;
6. Cigarette smoking;
7. ECG patterns.

Age, serum cholesterol, systolic blood pressure, and hemoglobin were used as absolute values. Relative body weight was calculated in terms of: (actual weight ÷ median body weight) x 100. Cigarette smoking was coded from 0 (never smoked) through 3, (greater than 1 pack daily). The ECG pattern was coded according to a dichotomy where interpretations were either negative or positive (indicating left ventricular hypertrophy, interventricular block, and/or non-specific abnormalities).

CHD risk scores were computed by means of two formulae: one according to predetermined age cohorts to which subjects were assigned at entry into the program (1968) and the other for individuals by means of incorporation of a combined age formula. It should be noted that since individuals were entered into specified age cohorts at the time of entry into the program and were shifted into other age cohorts as time passed, sample size differences existed on an annual basis.

FINDINGS:

Although the exercise stress test evaluation program began in November, 1968, CHD risk estimates were calculated from 1967 to determine if initial differences existed between the CHD scores for the test and comparison groups. Determination of CHD risk estimates prior to program entry was necessitated by the lack of randomization in subject group assignment. Perusal of Figure 1 displays the existence of initial, although non-significant, differences in the risk scores for the two groups. The lower risk score of the test group might have represented numerous underlying circumstances. It is possibie that participant self selection in the progam led to the lower risk score, or conversly, a greater awareness of CHD in the test group may have

existed due to a family history of coronary heart disease, which although not reflected in the risk score calculations, has been credited for an increase in susceptibility of CHD in close relatives (2,4).

Insert figure 1

about here

A regression analysis was performed in order to determine if the rate of acceleration of the risk estimates for the groups differed. As a result of the analysis, it was determined that both the slope and acceleration of the CHD risk scores for the comparison group differed significantly. That is, the CHD risk score of subjects not engaged in periodic cardiopulmonary stress test evaluation increased to significantly higher levels over a period of time than did those of subjects engaged in periodic evaluation of cardiopulmonary function. This is graphically displayed in FIGURE 1.

By means of a stepwise regression analysis, differences in the means of the CHD risk scores for the test group and the comparison group were determined. As can be seen in TABLE 1, although risk scores for the two groups as a whole (combined age) did not differ significantly upon entry into the program, scores for the comparison group were significantly greater than those in the test group for each year of participation in the exercise stress test program when comparing the combined age risk score means.

insert table 1

about here

Also presented in TABLE 1 are analysis of CHD risk estimate differences determined on the basis of age, representative of the aforemention age cohorts. Although the difference in the mean risk scores for the two groups is not as dramatic as when determined on the group as a whole (combined age), significant differences are nevertheless apparent.

SUMMARY AND CONCLUSIONS

Although an initial difference in CHD risk scores was observed, the difference was not great enough to be significant at the .05 level. As previously noted, the differences could be due to a variety of circumstances. Perhaps the most relevent was that there was a greater number of smokers in the comparison group, which implies that smokers were less interested in periodic cardiopulmonary stress test evaluation.

The observed difference between the risk scores of the test group and the comparison group deviated significantly after one year of participation in the Cardiopulmonary evaluation. Thus, despite the initial difference between the two groups, the acceleration rate of the increase in risk was much greater in the comparison group.

In light of the above observations, it appears that the following conclusions are justified and consistent with the findings of the study:

1. Probability estimates for quantifying the likelihood of CHD development are beneficial in identifying individuals and categorizing them according to degree of risk for examination of treatment prior to an overt cardiac event or to observe difference in risk among groups of people, i.e., male, female, age groups, or treatment groups. Since supporters of preventative medicine encourage the correction of risk factor abnormalities, particularly for those at higher risk of CHD, the use of CHD risk estimates appears valid and justifiable.

2. Comparison of probability estimates for CHD development indicated that the group involved in a periodic evaluation program of the cardiopulmonary systems which encouraged and prescribed personal physical fitness programs had lower risk estimates. The feedback provided test participants and the increased awareness of physiologic function may have altered the life styles of the participants. Consequently, the surveillance of performance capacities and the encouragement to maintain physical vigor may have modified the risk for developing CHD. The data appears to support the contention that sedentary individuals who participate on a regular basis in an exercise program have a significantly lower probability of developing CHD than individuals who do not participate in such a program.

TABLE I

COMPARISON OF CHD RISK SCORES BETWEEN TEST GROUP AND COMPARISON GROUP

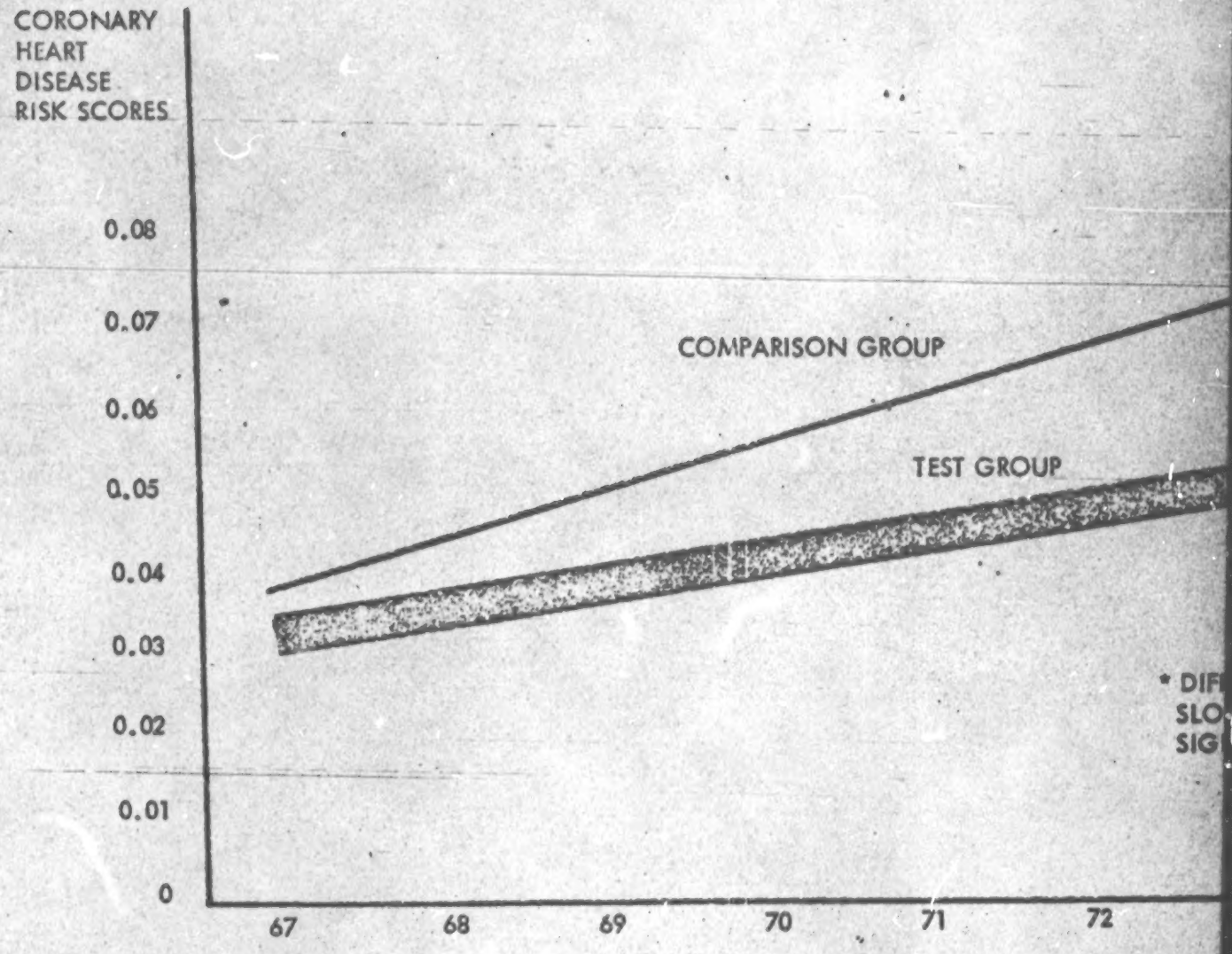
YEAR		COMBINED AGE	30–39	40–49	50–
1967	F-value	1.78	1.53	2.03*	1.0
	d.f.	8,339	8,207	8,98	8,1
1968	F-value	2.48*	2.70*	4.31*	0.8
	d.f.	8,355	8,193	8,123	8,2
1969	F-value	3.12*	2.80*	0.51	0.9
	d.f.	8,339	8,162	8,133	8,2
1970	F-value	3.63*	2.14*	1.42	1.3
	d.f.	8,381	8,158	8,168	8,3
1971	F-value	2.60*	0.67	0.72	2.4
	d.f.	8,391	8,133	8,186	8,5
1972	F-value	4.45*	0.90	2.89*	2.7
	d.f.	8,407	8,109	8,210	8,7
1973	F-value	3.22*	1.30	1.79	1.7
	d.f.	8,368	8,75	8,204	8,7
1974	F-value	6.15*	1.05	2.94*	2.3
	d.f.	8,363	8,47	8,219	8,7

* = significant at .05 level

TABLE I

COMPARISON OF CHD RISK SCORES BETWEEN TEST GROUP AND COMPARISON GROUP

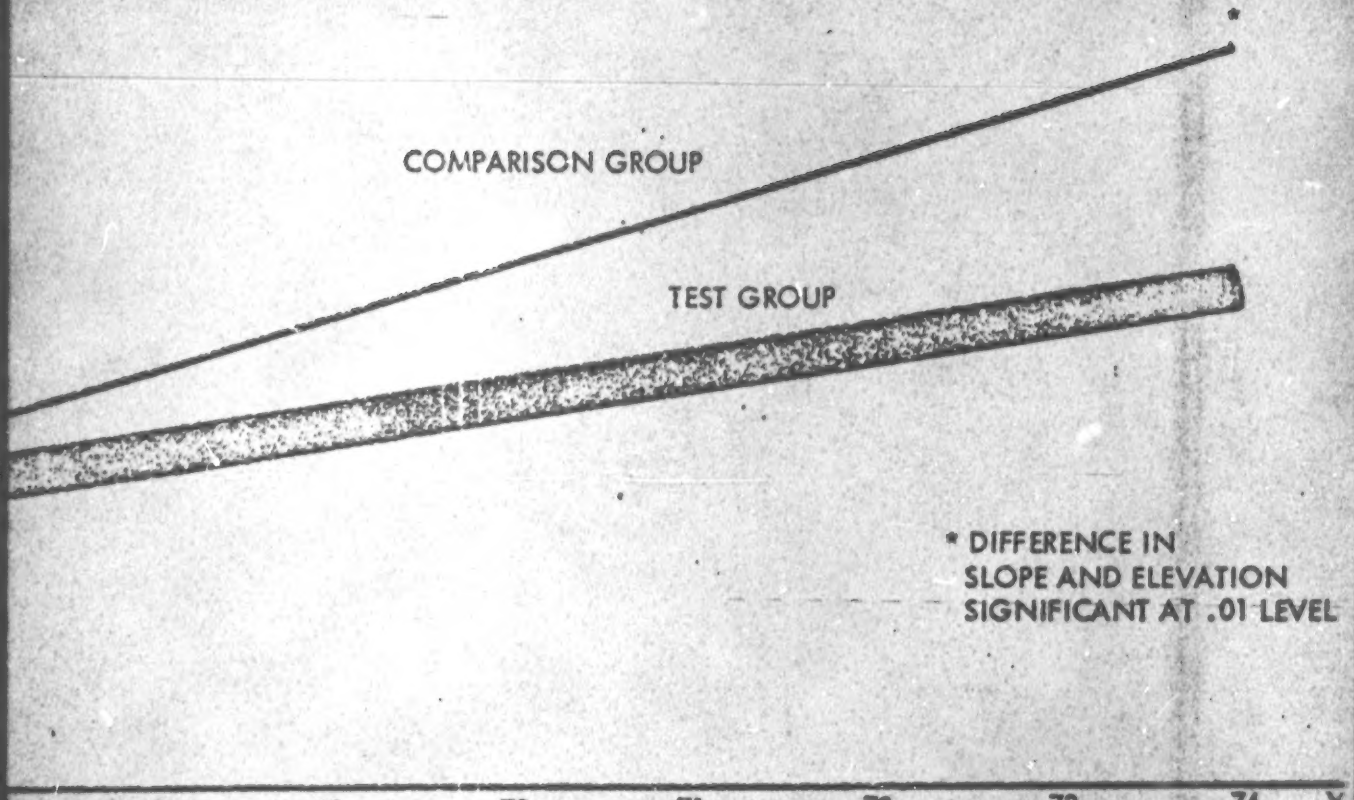
COMBINED AGE	30-39	40-49	50-59
1.78	1.53	2.03*	1.06
8,339	8,207	8,98	8,16
2.48*	2.70*	4.31*	0.85
8,355	8,193	8,123	8,21
3.12*	2.80*	0.51	0.94
8,339	8,162	8,133	8,26
3.63*	2.14*	1.42	1.38
8,381	8,158	8,168	8,37
2.60*	0.67	0.72	2.47*
8,391	8,133	8,186	8,53
4.45*	0.90	2.89*	2.75*
8,407	8,109	8,210	8,70
3.22*	1.30	1.79	1.72
8,368	8,75	8,204	8,71
6.15*	1.05	2.94*	2.34*
8,363	8,47	8,219	8,79



REGRESSION LINES OF CORONARY HEART DISEASE RISK SCORES, BY GROUP,

* DIF
SLO
SIG

FIGURE 1



GRESSION LINES OF CORONARY HEART DISEASE RISK SCORES, BY GROUP, BY YEAR

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